

40 North Central Avenue
Phoenix, Arizona 85004-4429

Sean D. Garrison (State Bar No. 014436)
Direct Dial: (602) 239-7434
Direct Fax: (602) 734-3939
E-mail: SGarrison@LRLaw.com

Shane Olafson (State Bar No. 024605)
Direct Dial: (602) 262-5327
Direct Fax: (602) 734-3756
E-mail: SOlafson@LRLaw.com

Attorneys for Plaintiff

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF ARIZONA

Dial Manufacturing, Inc., an Arizona
corporation,

Plaintiff,

vs.

USASIA Co., LLC, an Arizona limited
liability company; and Jerry Chun Fan and
Lei Bao, husband and wife,

Defendants.

No. 5,568, 000

COMPLAINT

For its Complaint, Plaintiff Dial Manufacturing, Inc. ("Dial") alleges as follows:

PARTIES

1. Plaintiff Dial is an Arizona corporation with its principal place of business in Phoenix, Arizona. Dial manufactures and sells replacement parts for evaporative coolers.

2. Defendant USASIA Co., LLC ("USASIA") is an Arizona limited liability company with its principal place of business listed as 636 E. Malibu Drive in Tempe, Arizona. USASIA imports and sells evaporative cooler products in competition with Dial.

3. Upon information and belief, Defendants Jerry Fan and Lei Bao are husband and wife, who reside in Alabama. Upon information and belief, Defendant Jerry Fan is a managing member of USASIA, and Defendant Lei Bao is an agent of USASIA.

4. Upon information and belief, Fan and Bao, individually and jointly, control, direct and carry out the activities of USASIA, including the importation, sale and offering to sell evaporative cooler products in competition with Dial giving rise to Dial's claims

MULTIPLE POLE, SHADED POLE SUBFRACTIONAL-HORSEPOWER INDUCTION MOTOR

This invention pertains to motors.

More particularly, the invention pertains to concentric, multiple pole, shaded pole, subfractional-horsepower induction motors.

Subfractional-horsepower induction motors have a horse-power (HP) of 1/20 HP or less, typically 1/150 HP to 1/20 HP. Such motors ordinarily include a single piece stator, an armature rotationally mounted in an opening in the stator, two or more primary poles, and two or more "shaded" or secondary poles. A shaded pole or coil is a piece of material than can conduct electricity to create another magnetic field inside the primary magnetic field generated in the motor. The primary magnetic field is generated by wire wrapped around a primary pole. The secondary pole or magnetic field gives the motor its initial direction and rotation when it starts. The secondary pole makes the motor spin by changing the characteristics of the magnetic field in the stator. Subfractional-horsepower motors are used to power water pumps in evaporative coolers and are used in other applications which require a small motor. The design and efficiency of subfractional horsepower induction motors have in large part remained unchanged for many years.

Accordingly, it would be highly desirable to provide an improved subfractional-horsepower induction motor and method for producing the same.

Therefore, it is a principal object of the invention to provide an improved subfractional-horsepower induction motor and method for producing the same.

A further object of the invention is to provide an improved subfractional-horsepower induction motor which permits the mounting of wound wire on the stator before the final assembly of the stator.

Another object of the invention is to provide an improved concentric subfractional-horsepower induction motor which utilizes an armature or rotor which can be interchangeably utilized on a C-frame stator in a subfractional-horsepower induction motor.

Still a further object of the invention is to provide an improved concentric subfractional-horsepower induction motor which utilizes reluctance gaps to force the primary magnetic field into the rotor or armature of the motor to increase the strength of the motor.

Yet another object of the invention is to provide an improved mounting bracket for a subfractional-horsepower induction motor.

These and other, further and more specific objects and advantages of the invention will be apparent to those skilled in the art from the following detailed description thereof, taken in conjunction with the drawings, in which:

FIG. 1 is a top view illustrating a metal lamina utilized to form the outer portion of the stator of the motor of the invention;

FIG. 2 is a side view further illustrating the lamina of FIG. 1;

FIG. 3 is a top view illustrating a metal lamina utilized to form the inner portion of the stator of the motor of the invention;

FIG. 4 is a side view further illustrating the lamina of FIG. 3;

FIG. 5 is a top view illustrating the rotor or armature utilized in the subfractional induction motor of the invention;

FIG. 6 is a side view illustrating the armature utilized in the subfractional induction motor of the invention;

FIG. 7 is a top view illustrating a lamina utilized to construct the rotor of FIGS. 5 and 6;

FIG. 8 is a side view illustrating a bobbin utilized on the inner portion of the stator of the motor of the invention to form the primary magnetic field in the motor;

FIG. 9 is a top view illustrating a bracket utilized to mount the motor of FIGS. 1 to 8;

FIG. 10 is a side view illustrating the bracket of FIG. 9; FIG. 11 is a front view illustrating the bracket of FIG. 9; FIG. 12 is a bottom view further illustrating the bracket of FIG. 9;

FIG. 13 is a section view further illustrating internal construction details of the bracket of FIG. 12 and taken along section line 13—13 thereof;

FIG. 14 is a section view further illustrating internal construction details of the bracket of FIG. 9 and taken along section line 14—14 thereof;

FIG. 15 is a top view illustrating the bearing utilized in the invention; and,

FIG. 16 is a side section view of the bearing of FIG. 15 taken along section line 16—16 and illustrating further construction details thereof.

Briefly, in accordance with my invention, I provide a method of assembling a concentric shaded pole subfractional horsepower induction motor. The motor includes a stator, at least one field winding, and an armature rotatable in a central opening in the stator about a longitudinal axis of the stator core. The method includes steps of winding wire on at least one bobbin; assembling the outer portion of the stator core by stacking in registration one on top of the other a plurality of laminas each of substantially equal shape and dimension, the outer portion of the stator core circumscribing and defining a first inner open space; assembling the inner portion of the stator core by stacking in registration one on top of other a plurality of laminas each of substantially equal shape and dimension, the inner portion of the stator core circumscribing and defining a second inner open space and shaped and dimensioned to receive shaded poles and to receive the bobbin; installing the bobbin and at least a pair of spaced apart shaded poles on the inner portion of the stator core; inserting the inner portion of the stator core in the inner open space in the outer portion; and, inserting an armature in the second inner open space, the armature including a rotatable shaft. A mounting bracket can be attached to the outer portion of the stator core with a bearing intermediate and contacting the armature and the bracket and at least partially circumscribing the rotatable shaft.

In another embodiment of my invention, I provide a concentric shaded multiple-pole subfractional horsepower induction motor including a stator. The stator includes an outer portion including a plurality of registered laminas each of substantially equal shape and dimension stacked one on top of the other. The outer portion circumscribes and defines a first inner open space. The stator also includes an inner portion including a plurality of registered laminas each of substantially equal shape and dimension stacked one on top of the other. The inner portion of the stator circumscribes and defines a second inner open space. At least a pair of shaded poles are mounted on the inner portion of said stator. At least one bobbin is mounted on the inner portion of the stator. At least two reluctance gaps are formed on the inner portion of the stator. Each reluctance gap is spaced apart from one of the shaded poles along an arc by 90 degrees or less. An armature is rotatably mounted in the second inner open space.

In a further embodiment of my invention, I provide a concentric shaded multiple-pole subfractional horsepower induction motor including a stator. The stator includes an outer portion including a plurality of registered laminas each of substantially equal shape and dimension stacked one on top of the other. The outer portion circumscribes and defines a first inner open space. The stator also includes an inner portion including a plurality of registered laminas each of substantially equal shape and dimension stacked one on top of the other. The inner portion of the stator circumscribes and defines a second inner open space. At least a pair of shaded poles are mounted on the inner portion of said stator. At least one bobbin is mounted on the inner portion of the stator. At least two pair of reluctance gaps are formed on the inner portion of the stator. The reluctance gaps in each of the pairs are being spaced apart along an arc by less than forty degrees. An armature is rotatably mounted in the second inner open space.

In still another embodiment of my invention, I provide a concentric shaded multiple-pole subfractional horsepower induction motor including a stator. The stator includes an outer portion including a plurality of registered laminas each of substantially equal shape and dimension stacked one on top of the other. The outer portion circumscribes and defines a first inner open space and has a selected width. The stator also includes an inner portion including a plurality of registered laminas each of substantially equal shape and dimension stacked one on top of the other. The inner portion of the stator circumscribes and defines a second inner open space. At least a pair of shaded poles are mounted on the inner portion of said stator. At least one bobbin is mounted on the inner portion of the stator. An armature is rotatably mounted in the second inner open space. The armature has a selected diameter. The ratio of the diameter to the width of each of the stator laminations is in the range of 1:2.36 to 1:4.4.

Turning now to the drawings, which depict the presently preferred embodiments of the invention for the purpose of illustrating the practice thereof and not by way of limitation of the scope of the invention, and in which like reference characters identify corresponding elements throughout the several views, FIG. 1 illustrates a steel lamina or plate 10 utilized in the construction of the outer portion of the stator of the motor of the invention. The inner peripheral edge 29 of the lamina 10 circumscribes and bounds an open inner area 28. Cylindrical apertures 38 and 39 are formed through lamina 10. Detents 12 and 13 are formed on the inside of lamina 10. The side view of lamina 10 in FIG. 2 shows the right hand edge 20 of the lamina. The width or diameter of lamina 10 equals twice the distance indicated by arrow A. Arcuate portions 10A, 10B, 10C, and 10D lie on the circumference of a circle having a radius indicated by arrow A. In the presently preferred concentric subfractional-horsepower induction motor constructed in accordance with the invention, the distance indicated by arrow A is 1.65 inches. The outer portion or outer laminate stack of the stator is formed by stacking a plurality of laminas 10 in conventional fashion in registration one on top of the other such that apertures 38 in each lamina are aligned with apertures 38 in the other stacked laminas and such that apertures 39 in each lamina are aligned with apertures 39 in the other stacked laminas.

FIG. 3 illustrates a steel lamina or plate 11 utilized in the construction of the inner portion of the stator of the motor of the invention. Lamina 11 includes slots pairs 25, 26 and 23, 24 and includes reluctance gap pairs 21, 22 and 16, 17. The distance between gaps 21 and 22 (or gaps 16 and 17) along an arc is presently 21 degrees, preferably about 20 to

22 degrees. However, the distance between gaps 21 and 22 (or gaps 16 and 17) indicated by arrows B can be in the range of 10 to 40 degrees depending on the desired construction of the concentric subfractional-horsepower shaded pole induction motor of the invention. Lamina 11 includes longitudinal axis Y and cylindrical aperture 27 formed there-through. The inner cylindrical surface of aperture 27 circumscribes and bounds open area 30. Normal axes Y and Z cut circular area 30 into four pie shaped quadrants I, II, III, IV. Reluctance gaps 21, 22 and slots 23, 24 lie in quadrant II, i.e., both gaps 21, 22 are within ninety degrees of slots 23, 24. Consequently, the length of the arc indicated by arrows C is less than ninety degrees. Reluctance gaps 16, 17 and slots 25, 26 lie in quadrant IV, i.e., both gaps 21, 22 are within ninety degrees of arc of slots 25, 26. Flat planar edges 18A, 18B, 18C, 18D are each of equivalent shape and dimension. Nubs 14 and 15 are formed at opposite ends of lamina 11.

The side view of lamina 11 in FIG. 4 shows the planar flat edge 31 of the lamination. The thickness T1 of lamina 10 equals the thickness T2 of lamina 11.

The inner portion of the stator of the motor is formed by stacking a plurality of laminas 11 in conventional fashion in registration one on top of the other such that aperture 27 in each lamina is aligned with the apertures 27 in the other stacked laminas and such that slots 24, 26 in each lamina are aligned with slots 24, 26, respectively, in the other stacked laminas. The number of laminas 11 utilized to make the inner portion of the stator equals the number of laminas 10 utilized to make the outer portion of the stator. After the inner laminas 11 are registered one on top of the other to form an inner laminate stack, a strip of copper 19 (FIG. 3) or other desired material is threaded up through slots 24, over the top of the inner laminate stack, down through aligned slots 23, and over the bottom of the inner laminate stack. Copper strip 19 forms a shaded pole. Another copper strip is similarly threaded through slots 25 and 26 to form a second shaded pole. One bobbin, indicated by dashed lines 18 in FIG. 3, is slid over the left hand end of the inner laminate stack of FIG. 3 to the position shown. Bobbin 18 bears against the flats formed by surfaces 18A and 18B. Another bobbin (not shown) is slid over the right hand end of the inner laminate stack of FIG. 3 and against the flats formed by surfaces 18C and 18D. Each bobbin 18 comprises a rectangular sleeve 37 wound with wire 36 (FIG. 8).

After bobbins and shaded poles have been installed on the inner laminate stack, the stack is positioned in open space 28 inside the outer laminate stack by simultaneously (1) sliding stack nubs 14 through the groove which is on the inside of the outer laminate stack and which is formed by stacked detents 12 and (2) sliding stacked nubs 15 through the groove which is on the inside of the outer laminate stack and which is formed by stacked detents 13. The inner laminate stack is so inserted in the outer laminate stack until the top and bottom surfaces of the inner and outer stacks are coplanar and until each lamina 10 is coplanar with one of the laminas 11 in the inner laminate stack. The coplanar position of each lamina 11 in the inner stack with one of the laminas 10 in the outer stack is illustrated by dashed lines 11A in FIG. 1.

After the inner and outer laminate stacks are pressed together in the manner described above, a rotor 32 is inserted inside the inner laminate stack. The rotor 32 includes top surface 34 and shaft 35 having a longitudinal axis which is perpendicular to axes Y and Z and which is collinear with the center line of the cylindrical opening in the inner laminate stack which is formed by the registered openings 27 in the

inner laminate stack. FIG. 7 illustrates a circular lamina 33 utilized in fabricating rotor or armature 32. When the diameter of lamina 10 is about 3.3 inches, the diameter of each lamina 33 is typically about one and a half inches. In the invention, the diameter of each lamina 33 has been reduced such that the ratio of the diameter of lamina 33 to the diameter or width of lamina 10 is in the range of 1:2.2 to 1:4.4. Reducing the size of the rotor enables the amount of metal in the stator to be increased so that the magnetic saturation point is not reached as quickly as when the stator has less mass. Further, reducing the diameter of the rotor facilitates using the rotor in a C-frame subfractional-horsepower shaded pole induction motor of comparable or smaller size to the concentric motor illustrated in FIGS. 1 to 8. By way of example, when the diameter of lamina 10 is 3.3 inches, the diameter of lamina 33 (and of rotor 32) is preferably in the range of 0.75 to 1.4 inches and is preferably, but not necessarily, less than the conventional diameter of one and a half inches.

After the rotor 32 is placed inside the inner stator stack, self aligning porous metal bearings 36 are placed over shaft 35 on the top and bottom of rotor 32 (FIG. 6). A first mounting bracket 40 is then placed over the top surface 34 of rotor 32 such that feet 53 and 54 seat in apertures 38 and 39, respectively, of the lamina 10 on the top of the outer laminate stack (FIG. 10), such that shaft 35 extends upwardly through opening 47, such that bearing 36 on top of rotor 32 seats in semispherical surface 55 (FIGS. 12 and 13) of the bracket 40, and such that elongate cylindrical pin 70 extending outwardly from bracket 40 (FIGS. 12 and 13) extends into a slot 63 of bearing 36 to prevent the rotation of bearing 36. Shaft 35 also extends upwardly through cylindrical opening 64 in bearing 36. A second bracket 40 is then placed over the bottom surface 60 of rotor 32 such that feet 53 and 54 of the second bracket seat in apertures 38 and 39, respectively, of the lamina 10 on the bottom of the outer laminate stack, such that shaft 35 extends downwardly through opening 47 of the second bracket 40, and such that bearing 36 on the bottom of the rotor 32 seat in semispherical surface 55 of the second bracket 40. After the first and second mounting brackets are positioned as described, a first elongate bolt 61 is passed through apertures 43 and 38 and a nut is utilized to tighten the mounting brackets and laminae 10 together. A second elongate bolt 62 is passed through aperture 50 and 39 and a nut is utilized to tighten the mounting brackets and laminae 10 together. The first and second elongate bolts can also, in addition to passing through apertures 43, 38 and 50, 39, respectively, be long enough to pass through apertures in the housing of an evaporative cooler pump so that the assembled motor can be secured to the pump with nuts. Or, the motor can otherwise be secured to an evaporative cooler pump or to some other structure.

In FIGS. 9 to 13, mounting bracket 40 includes upper flat surface 41; apertures 42 to 44; circular flat surface 46; aperture 47; upper flat surface 52; apertures 48, 50, 51; tabs 45 and 49 to receive ground wire clips; feet 53 and 54; inner cylindrical surface 56 on the bottom of bracket 40; and, semispherical surface 55 on the bottom of bracket 40.

Having described my invention in such terms as to enable those skilled in the art to understand and practice it, and having described the presently preferred embodiments thereof,

I claim:

1. A concentric shaded multiple-pole subfractional horsepower induction motor including

(a) a stator including

- (i) an outer portion including a plurality of registered laminations each having a selected width and being of substantially equal shape and dimension stacked one on top of the other, said outer portion circumscribing and defining a first inner open space;
- (ii) an inner portion including a plurality of registered laminations each of substantially equal shape and dimension stacked one on top of the other, said inner portion of said stator core circumscribing and defining a second inner open space, and including first and second pole tip portions;

(b) at least a pair of shaded poles on said inner portion of said stator;

(c) at least one bobbin on said inner portion of said stator;

(d) at least first and second pairs of reluctance gaps on said inner portion of said stator, the reluctance gaps each being spaced apart from one of said shaped poles along an arc by 90 degrees or less, each of said first and second pairs of reluctance gaps being formed in a different one of said first and second pole tip portions, the reluctance gaps in each of said pairs being spaced apart along an arc of less than forty degrees;

(e) a cylindrical armature rotatably mounted in said second inner open space, said armature having a selected diameter, the ratio of said diameter to said width of each of said stator laminations in said outer portion being in the range of 1:2.36 to 1:4.4.

2. The motor of claim 1 wherein said diameter of said armature is in the range of 0.75 to 1.4 inches.

3. The motor of claim 2 wherein the distance along an arc between the reluctance gaps comprising each of said pair of reluctance gaps is in the range of twenty to twenty-two degrees.

4. The motor of claim 3 wherein each of the reluctance gaps opens outwardly from said second inner open space.

5. A water pump for an evaporative cooler, said pump including pump means and a concentric shaded multiple-pole subfractional horsepower induction motor to drive said pump means, said motor including

(a) a stator including

- (i) an outer portion including a plurality of registered laminations each having a selected width and being of substantially equal shape and dimension stacked one on top of the other, said outer portion circumscribing and defining a first inner open space;
- (ii) an inner portion including a plurality of registered laminations each of substantially equal shape and dimension stacked one on top of the other, said inner portion of said stator core circumscribing and defining a second inner open space, and including first and second pole tip portions;

(b) at least a pair of shaded poles on said inner portion of said stator;

(c) at least one bobbin on said inner portion of said stator;

(d) at least first and second pairs of reluctance gaps on said inner portion of said stator, the reluctance gaps each being spaced apart from one of said shaped poles along an arc by 90 degrees or less, each of said first and second pairs of reluctance gaps being formed in a different one of said first and second pole tip portions, the reluctance gaps in each of said pairs being spaced apart along an arc of less than forty degrees; and,

(e) a cylindrical armature rotatably mounted in said second inner open space, said armature having a selected diameter, the ratio of said diameter to said width of each of said stator laminations in said outer

7

portion being in the range of 1:2.36 to 1:4.4, said diameter of said armature permitting said armature to be utilized in a C-frame shaded multiple-pole subfractional horsepower induction motor for a water pump for an evaporative cooler.

6. The pump of claim 5 wherein said diameter of said armature in said concentric motor is in the range of 0.75 to 1.4 inches.

8

7. The pump of claim 6 wherein the distance along an arc between the reluctance gaps comprising each of said pair of reluctance gaps is in the range of twenty to twenty-two degrees.

8. The pump of claim 6 wherein each of the reluctance gaps opens outwardly from said second inner open space.

* * * * *

1 asserted in this Complaint. Upon further information and belief, the actions by Fan and
2 Bao were taken for the benefit of their marital community.

3 **JURISDICTION AND VENUE**

4 5. This is an action for patent infringement arising under the patent laws of the
5 United States, 35 U.S.C. § 1, *et seq.*

6 6. This Court has subject matter jurisdiction over this dispute pursuant to 28
7 U.S.C. §§ 1331, 1338(a), and 1367(a).

8 7. This Court may assert personal jurisdiction over the Defendants because
9 Defendants have each caused or contributed to the manufacturing, importing, sale, offering
10 for sale, and/or distribution of products that infringe Dial's patent rights in the United
11 States, and particularly in this judicial district and, as a result, Dial has been injured in this
12 judicial district.

13 8. Venue is proper in this Court pursuant to 28 U.S.C. §§ 1391(b) and 1400(b)
14 because Defendants have committed acts of infringement in this judicial district and, upon
15 information and belief, USASIA has a regular and established place of business here.

16 **DIAL'S BUSINESS AND PATENT**

17 9. Dial has designed, manufactured and provided reliable replacement parts for
18 the evaporative cooler industry since 1965, including cooler fittings, electrical accessories,
19 pumps, motors, thermostats, and switches, among other things.

20 10. Dial is the owner by assignment of all right, title, and interest in and to
21 United States Patent No. 5,568,000 (the "Dial Patent") entitled "Multiple Pole, Shaded
22 Pole Subfractional-Horsepower Induction Motor," which duly and legally issued in the
23 name of John Hanneken on October 22, 1996. A copy of the Dial Patent is attached
24 hereto as Exhibit A.

25 11. Without Dial's authorization, Defendants have made, used, offered to sell,
26 sold, and/or imported into the United States evaporative cooler water pumps and pump
27 motors that infringe at least claims 1 and 5, and possibly others, of the Dial Patent (the
28 "Infringing Products"). Defendants have also induced and/or contributed to the

1 manufacture, sale, offer for sale, use and/or importing of the infringing products by others.

2 12. Included among the Infringing Products are pump models RP11000 and FP-
3 7500, and possibly others.

4 **COUNT I**

5 **(PATENT INFRINGEMENT)**

6 13. Dial re-alleges each and every allegation set forth in paragraphs 1 through 12
7 above, and incorporates them by reference herein.

8 14. Dial has standing to sue for infringement of the Dial Patent because it is the
9 owner of the Dial Patent.

10 15. Defendants have infringed, and continue to infringe, the Dial Patent by
11 making, using, offering to sell, selling, and/or importing into the United States, the
12 Infringing Products.

13 16. Upon information and belief, Defendants' infringement has been intentional
14 and willful, making this an exceptional case. Defendants' pump motor is a nearly exact
15 replica of the motor contained in Dial's patented pump, the packaging for which is
16 consistently marked with the Dial Patent number. The particular configuration and
17 features of Dial's pump motor, coupled with that fact that Defendants' pump motors are
18 virtually identical, indicates that Defendants intentionally copied the patented design
19 claimed in the Dial Patent.

20 17. Defendants infringement has caused and continues to cause irreparable harm
21 to Dial, which has no adequate remedy at law and will continue to be injured unless and
22 until this Court enters a preliminary and permanent injunction prohibiting further
23 infringement and, specifically, enjoining Defendants and all others who have notice of the
24 injunction from further manufacture, use, offer for sale, sale and importation of products
25 that fall within the scope of claims of the Dial Patent.

26 18. Dial is entitled to recover damages from Defendants in an amount adequate
27 to compensate Dial for the infringement that has occurred and that will continue to occur
28 until an injunction is issued by the Court.

RELIEF REQUESTED

A. Judgment that the Defendants have infringed the Dial Patent in violation of 35 U.S.C. § 271 and that such infringement is willful;

B. A preliminary and permanent injunction prohibiting Defendants, and their affiliates, officers, directors, agents, servants, employees, and all persons in active concert or participation with them, from infringing, contributing to the infringement of, and inducing infringement of the Dial Patent;

C. An award of damages in accordance with 35 U.S.C. § 284, together with interest thereon running from the first date of infringement until such damages are paid;

D. An award of treble damages as a result of Defendants' willful patent infringement;

E. An award of Dial's costs, plus an award of its reasonable attorney's fees in accordance with 35 U.S.C. § 285; and

F. Such other and further relief as this Court deems just and proper.

DEMAND FOR JURY TRIAL

Dial demands a jury trial on all triable issues raised in this Complaint.

RESPECTFULLY SUBMITTED this 14th day of April, 2010.

LEWIS AND ROCA LLP

By /s/ Sean D. Garrison
Sean D. Garrison
Shane E. Olafson
Attorneys for Dial Manufacturing, Inc.



US005,568,000A

United States Patent [19][11] **Patent Number:** **5,568,000****Hanneken**[45] **Date of Patent:** **Oct. 22, 1996**[54] **MULTIPLE POLE, SHADED POLE
SUBFRACTIONAL-HORSEPOWER
INDUCTION MOTOR**

3,609,427	9/1971	Lautner et al.	310/258
3,634,707	1/1972	Tillner et al.	310/172
4,045,698	8/1977	Morrill	310/166
4,638,201	1/1987	Feigel	310/216
5,036,237	7/1991	London	310/254

[75] **Inventor:** John B. Hanneken, Tempe, Ariz.**FOREIGN PATENT DOCUMENTS**[73] **Assignee:** Dial Manufacturing, Inc., Phoenix, Ariz.

0012547	1/1983	Japan	310/259
1090996	11/1967	United Kingdom	310/259
9308631	4/1993	WIPO	310/216

[21] **Appl. No.:** 311,942[22] **Filed:** Sep. 26, 1994[51] **Int. Cl.⁶** H02K 1/00[52] **U.S. Cl.** 310/254; 310/258[58] **Field of Search** 310/182, 183,
310/216, 254, 258, 259[56] **References Cited****U.S. PATENT DOCUMENTS**

2,172,191	9/1939	Denman	171/252
2,500,191	3/1950	Lee	318/325

Primary Examiner—Thomas M. Dougherty
Attorney, Agent, or Firm—Tod R. Nissle

[57] **ABSTRACT**

A multiple pole, shaded pole, subfractional-horsepower induction motor includes a two piece stator. Wound wire is mounted on one piece of the stator before final assembly of the stator. Reluctance gaps are utilized to increase the strength of the motor.

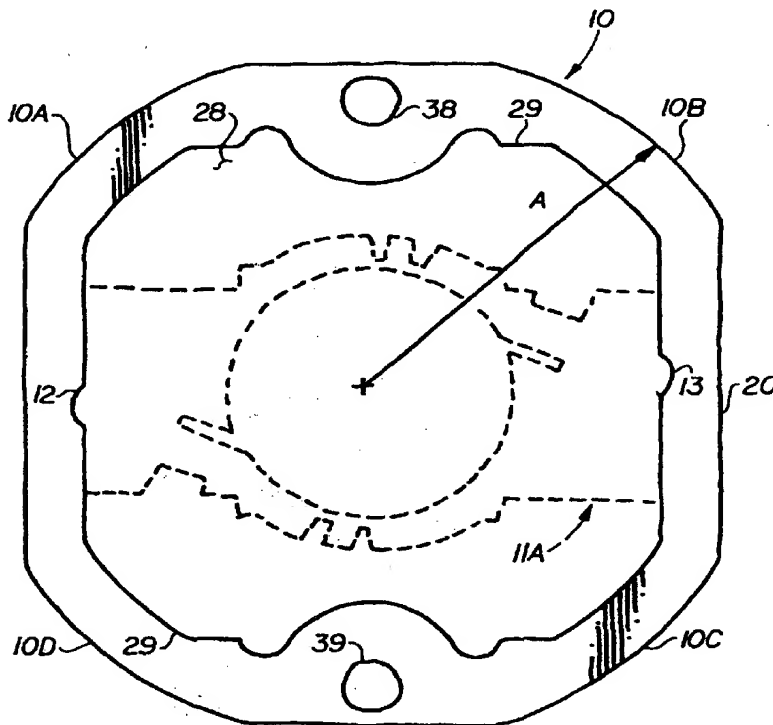
8 Claims, 4 Drawing Sheets

FIG. 1

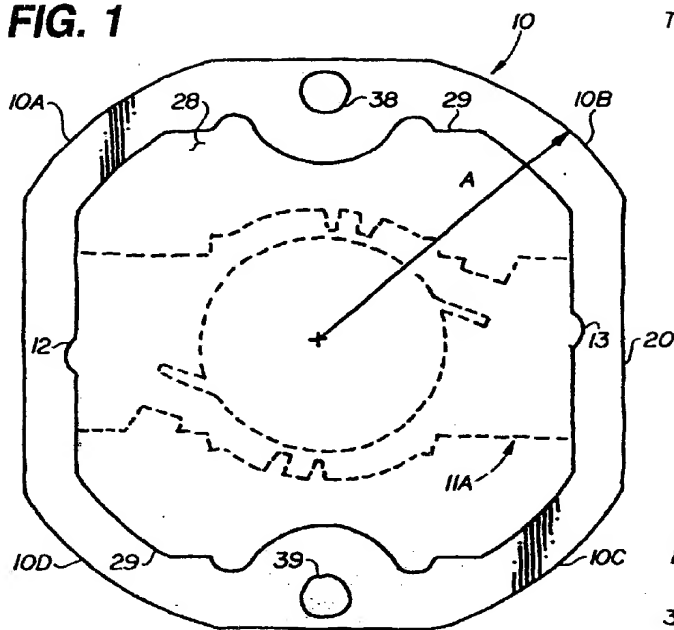
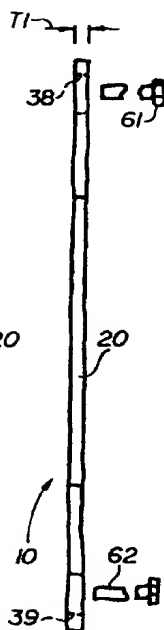
**FIG. 2**

FIG. 3

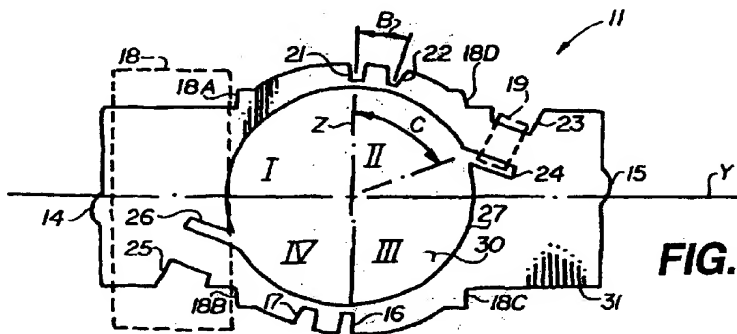
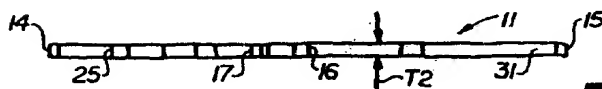


FIG. 4



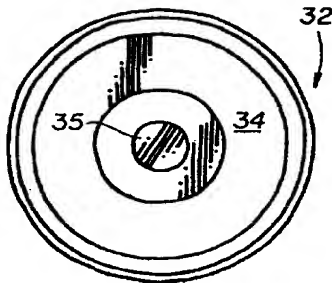


FIG. 5

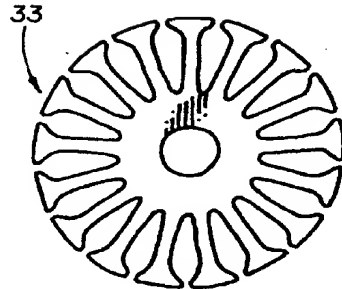


FIG. 7

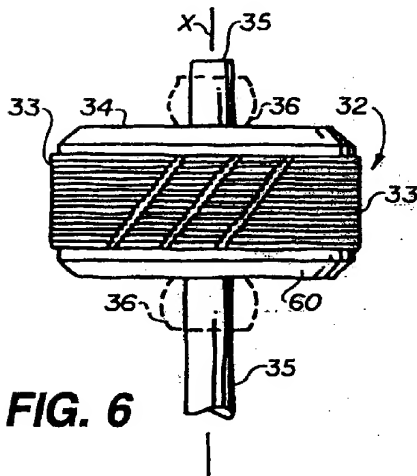


FIG. 6

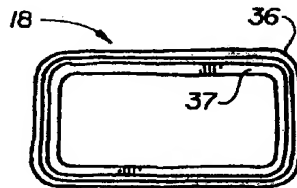
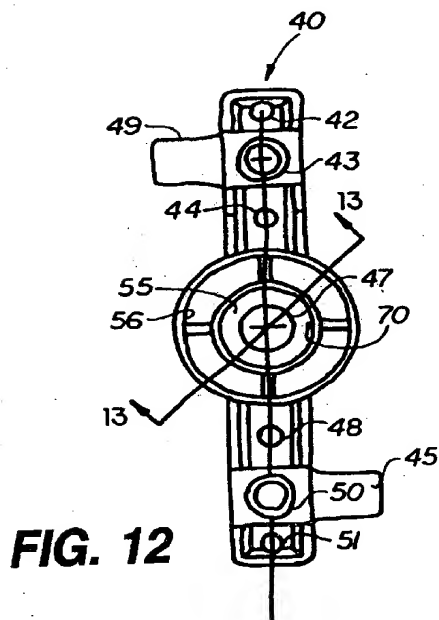
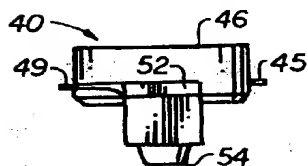
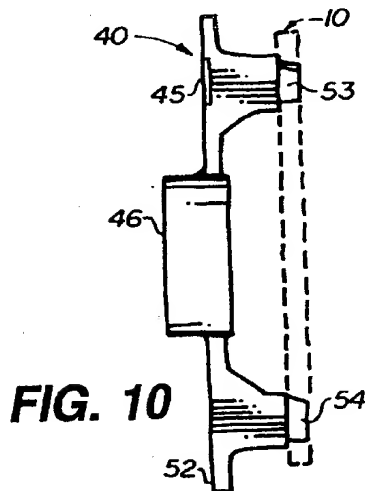
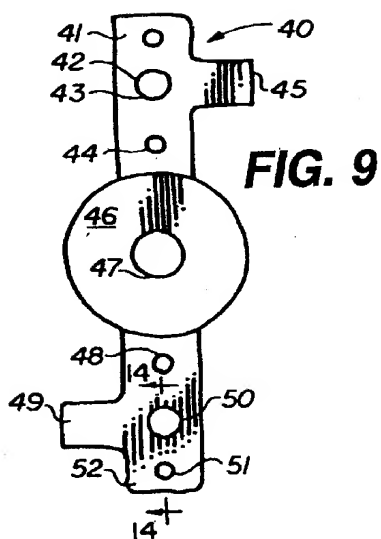


FIG. 8



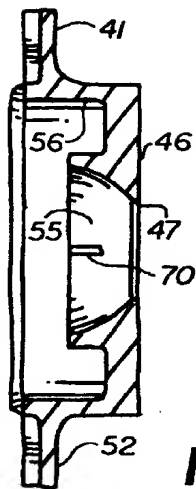


FIG. 13

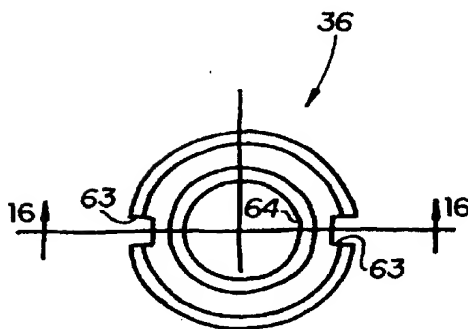


FIG. 15

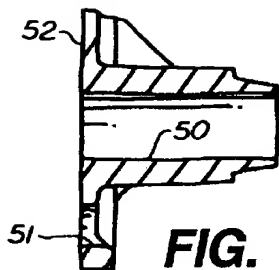


FIG. 14

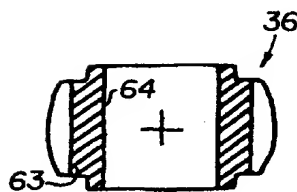


FIG. 16